USER MANUAL
FOR
BIOSCANNER MICRO AND MACRO
FISH COUNTERS

VAKI AQUACULTURE SYSTEMS

EDITION: SEPTEMBER 2006
PROGRAM VERSION: 3.38

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1 PREFACE – THE BIOSCANNER MICRO & MACRO

Vaki Aquaculture Systems Ltd thank you for choosing the Bioscanner MICRO and MACRO range of fry and smolt counters. These counters are used in many aquaculture enterprises where an accurate knowledge of fish numbers is important. Applications include counting fish when grading, accurate stock control when transferring fish between tanks and delivering fish by helicopter, well boat and truck.

The Vaki Bioscanner MICRO and MACRO counters have been developed in collaboration with a number of leading fish farming companies and are currently being used for counting Atlantic and Pacific salmon, trout, sea bass, sea bream, cod, and flatfish. Vaki continue to develop the functions on the counters and for use with additional species including prawn, shrimp and ornamental fish.

Both counters are based on a digital scanning camera and computer vision. The outlines of objects that pass beneath the camera are recorded and specially designed software is used to analyse the images and count the individual fish. The fish enter the counter and the water from the fish pump or spray bar then carry the fish over the curved counting channel. The fish pass over a light source and a mirror above reflects the images of each fish into the digital camera where the outlines are recorded and counted.

The MICRO is ideal when counting small fish from 0.2 g and has a 500mm wide counting channel, the MACRO channel is 1000mm wide and ideal for counting both fry and larger fish such as smolts. Both counters can be supplied with multi counting channels, which can be used to count separate batches of fish simultaneously, for example when grading.

This manual is a guide to the use of the Bioscanner MICRO and MACRO counters.

2 WARRANTY

Vaki Aquaculture Systems Ltd. offers warranty for defects that appear within one (1) year from the date of delivery from Vaki Iceland, on condition that the equipment has been assembled, used, and maintained in accordance with the instructions for assembly and use. Changes to the start date of this warranty, such as delayed delivery to the user, must be reported to Vaki upon receipt of the equipment and agreed in writing.

Vaki undertakes to repair all defects that are due to faults in the design, materials used, or manufacture of the equipment. These defects will be rectified by repairing the equipment, or replacing components. The complete unit or parts thereof may be required to return to the factory in Iceland for repair.

Vaki accepts corresponding warranty for original parts fitted by Vaki as replacements, for a period of one (1) year from the date supplied.

Vaki will ***not*** be liable for:

- *Incorrect assembly and use, or inadequate maintenance.*
- *Defects which result from the fitting of materials, components, or devices not supplied by Vaki, and which are purchased and fitted by the user.*
- *Defects due to changes made to the equipment by the user, without the written consent of Vaki.*
- *Faulty or inadequate repairs carried out by the user.*
- *Normal wear and tear of the equipment.*
- *Faulty connection of electrical equipment.*
- *Faults caused by excessive voltage.*
- *Damage or stoppage due to immersion of the computer or camera in water.*
- *Damage to electrical supply cables.*
- *Any economic loss that may arise from production stoppage.*

If faults or defects appear in the equipment, the user must report this in writing to Vaki or its appointed representative as soon as possible, and without unjustifiable delay. The report must be sent within two (2) weeks from the expiry of the deadline, which is one (1) year from the date of supply by Vaki Iceland.

<u>If the purchaser does not inform Vaki or its representative within the time limits stated above, the purchaser shall forfeit the rights of the warranty.</u>

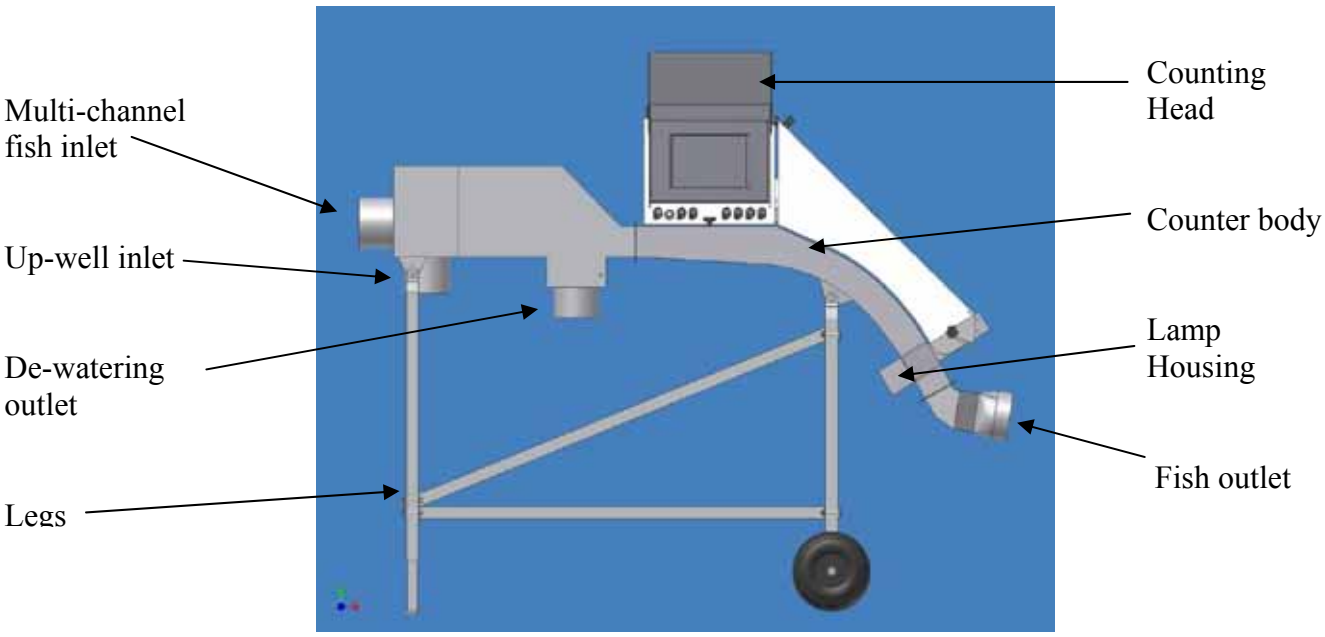
3 ASSEMBLY

After delivery, the main parts of the counter may need to be bolted together. These are the Counting head, Counter body, legs, inlet, and outlet. The legs are assembled and fitted with the wheels at the front and the inlet and outlet tubs bolted to the counter body as shown.

To ensure the camera inside is correctly positioned it is important that the counting head is securely fitted onto the main chassis and firmly seated on the four corner pads.

Fasten all nuts tightly

The Micro / Macro can be supplied as a single channel unit or with multiple channels or with different options. The four-channel Macro counter is shown. The main steps in the assembly are always the same but there may be different inlets and outlets according to customer needs.



Other equipment supplied:

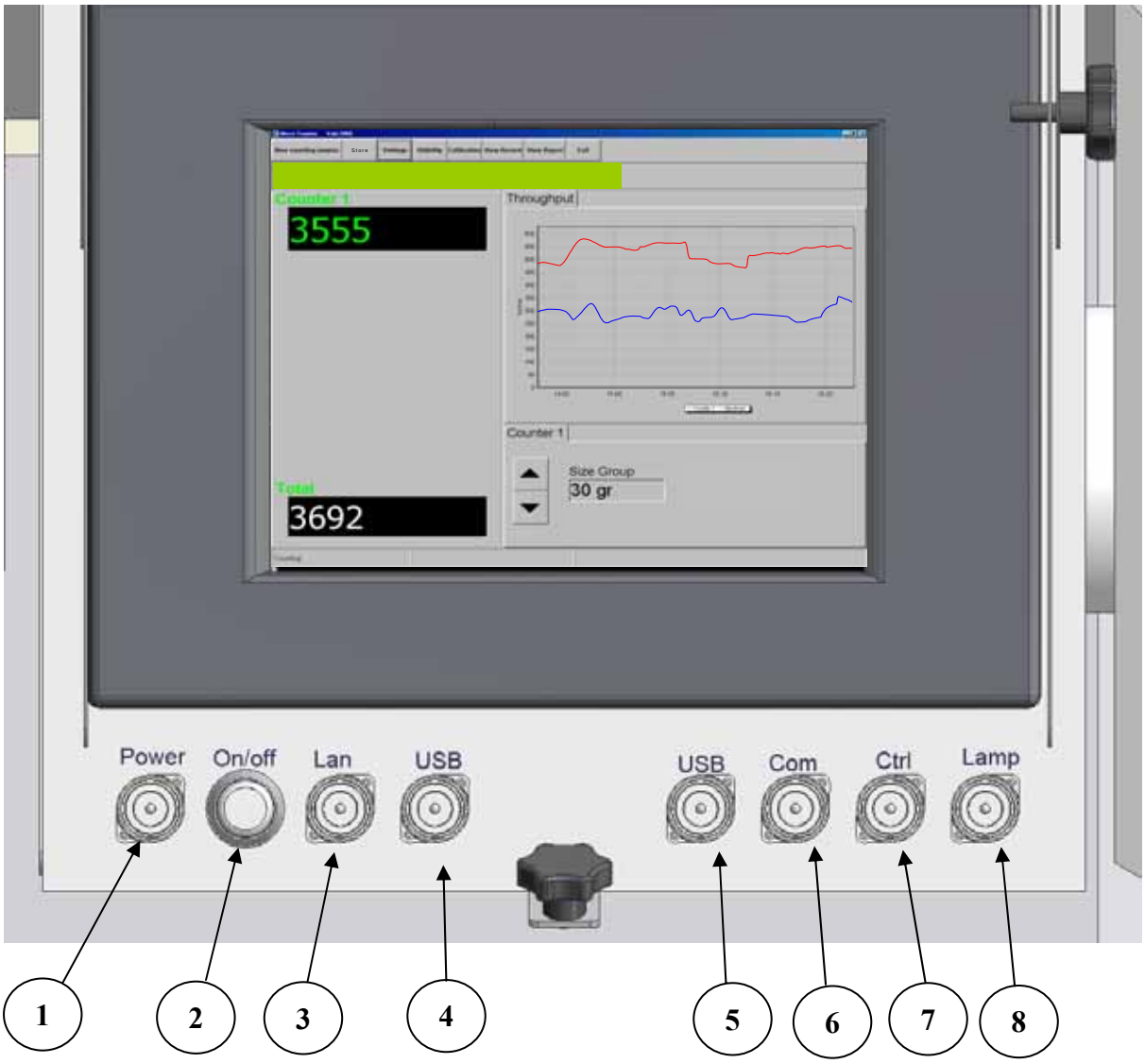
2 x USB cables 1 x Standard LAN cable 1 x Power cable 1xCounter Manual
1 x Bottle Vaki Fluid 1 x External Alarm 1 x Computer Manual

Optional equipment includes:

Biomass Function, UPS 80 – 100W (un-interrupted power supply), USBKeyboard, Mouse& Printer, 2 –way Batch splitter, CD reader/writer, Twisted LAN cable. Internal heating kit.

4 COUNTING HEAD

The counting head contains the camera, computer, and touch screen.
On the front are connections and ports required to connect the counter to power supply, lamp, and for external equipment such as printer, keyboard, external alarm, batch splitter.



1. Connection for main earthed power.
2. On /off power switch.
3. Local Area Network (LAN) connection.
4. USB port, for keyboard, printer, mouse.
5. USB port as above.
6. Serial Communication Port.
7. Control port for overload/batch alarm, batch splitter.
8. Lamp connection.

5 SET UP

When setting up the MICRO or MACRO it is important to note the following:

- The counter should be placed on a flat and stable surface.
- Using the level indicator on the frame set the counter level by adjusting the height of the legs to ensure both fish and water are evenly spread across the scanning area.
- Locate the counter so that the touch screen is easily accessible and not exposed to water or direct sunlight. Note that in hot weather, high temperatures can affect the computer.
- Before each count check that the mirror is completely clean and free from any stains, residue or water droplets.
- Ensure that all pipes and hoses are securely fastened.
- Connect the lamp cable to lamp connection on counting head.
- Connect external alarm or batch splitter to the "Ctrl" port
- Connect the power cable to earthed power outlet. The use of a UPS (un-interrupted power supply) device is recommend. The counter power requirement is 80-100W**.**
- Ensure that water and fish have a continuous free flow from the counter. Backpressure in the pipes can overload the counter.
- Take care not move or shake the counter while it is operating to protect against hard disk failure.

5.1 Pumping

When using a fish pump to transfer fish to the counter it is important to ensure an even flow of fish and water. Uneven delivery of fish to the counter can cause inaccurate counting as the number of fish may exceed the capacity limits.
It is also important to test the counter on the correct fish size settings pumping water only to ensure excess water does not create over-counting and adjust pump as required.
Ref: section **7.2 "Test with water only"**

5.2 Vacuum pumps

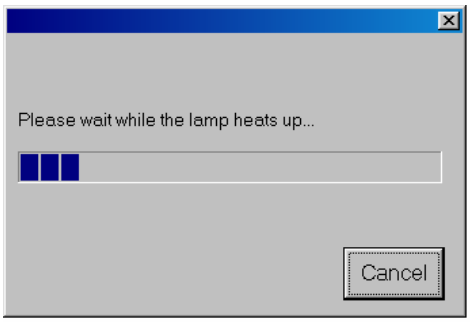
When using larger vacuum pumps it may be necessary to provide additional dewatering or a buffer tank. Short bursts of many fish can overload the counter and both excess water and white water can affect the performance of the counter particularly when counting smaller fish.

5.3 Netting

When netting the fish into the counter it is similarly necessary to supply a sufficient amount of water for gentle handling of the fish and maintain an even flow of fish over the curved counting channel.

6 START UP

The counter is now assembled and set up as instructed.
Turn on counter.
Wait for approximately 10 minutes as the software is started and lamp heats up. The following window will be shown on screen.
If the counter has been used recently and the lamp has not cooled it is possible to skip this by pressing, "**Cancel**".
The main screen will then be shown.



7 MAIN SCREEN

The features and options shown on the main screen are as follows.

1. "**New counting session**" starts a new counting session, once activated this button will change to "**End counting session**"
2. "**Store**" to store an intermediary batch count to the counting report.
   Reminder: remember to store the last batch before ending the counting session
3. "**Settings**" access settings menus.
4. "**Visibility**" used to display the graph showing intensity of light detected by camera.
5. "**Calibration**" to automatically calibrate the counter.
6. "**View Record**" to view recorded images.
7. "**View Report**" to view counting reports.
8. "**Exit**" to close the software before switching of counter.

A. **"Counting"** / or "**Not counting**" message indicates if counter is ready to count. **If this area turns red and shows as "Not counting" and the error message "visibility insufficient"** appears, please refer to Calibration & Visibility Section of this manual.
B. **Total** count including all batches stored in the counting session.
C. Channel label. The name of the label can be changed in settings.
D. Buttons to set the size group closest to average fish size to be counted
E. **Size group** selected with size group buttons.
F. **Throughput** graph, the blue line shows the rate of fish passing through the counter and **the red shows the maximum capacity the counter can accept.**
G. Progress Bar indicates the rate of fish passing through the counter, **turning red when over capacity.**
H. Intermediate batch count.

7.1 Set Fish Size

The size groups are: 0.2g, 1g, 3g, 10g, 30g, 100g & 200g

Using the size group buttons set the size group closest to the average size you intend to count. Each size setting covers a range of fish approximately 5 x smaller and 5 x larger than the size setting.

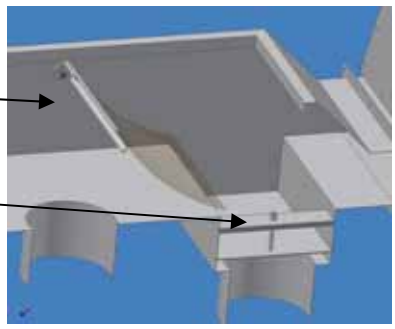
Should sensitive settings for very small fry count small air bubbles, water disturbance, or suspended particles it is advisable to increase the initial size range.

7.2 Test with water only

Adjust the amount of water from the fish pump to suit the size of fish being counted. With smaller fish, reduce the amount of water as much as possible running through the counter to prevent miscounting. Use the dewatering valve to adjust the water level.

The plastic flap is used to even the flow of water and fish through the counter.

The dewatering valve is adjusted using this screw

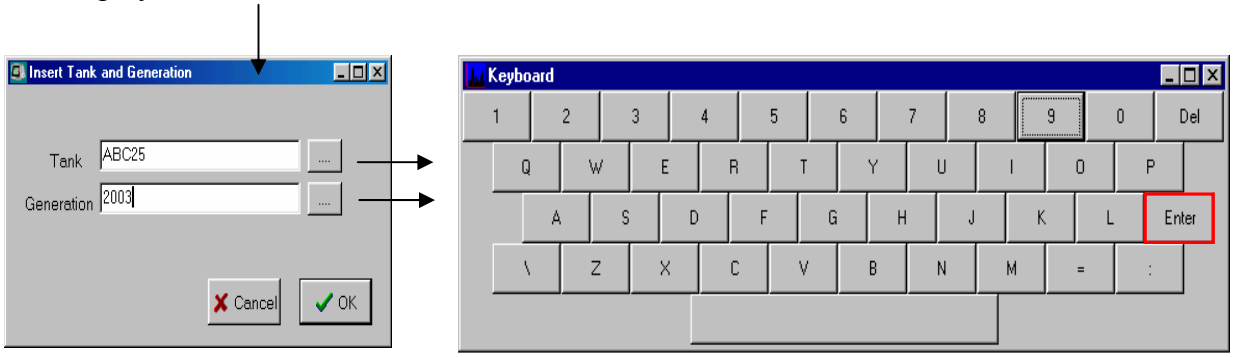


Test run with water only through the counter and check that the counter does not show any counts due to water disturbance.
It may be necessary to adjust the flow of water to prevent this, particularly with small fry. If the counter is "counting the water", this may be due to:

- The surface of the mirror is dirty or has water splashes.
- Too much water is being pumped through the counter.
- The water may be too dirty.
- The counter is not level and/or the water is not evenly spread over the counting channel.
- The size range setting is too sensitive.

7.3 Start Counting Session

To start counting press "**New counting session**" button on the main screen.
The display will show:


Insert Tank and Generation
Tank
ABC25
Generation
2003
Cancel
OK
Keyboard
1 2 3 4 5 6 7 8 9 0 Del
Q W E R T Y U I O P
A S D F G H J K L Enter
\ Z X C V B N M = :

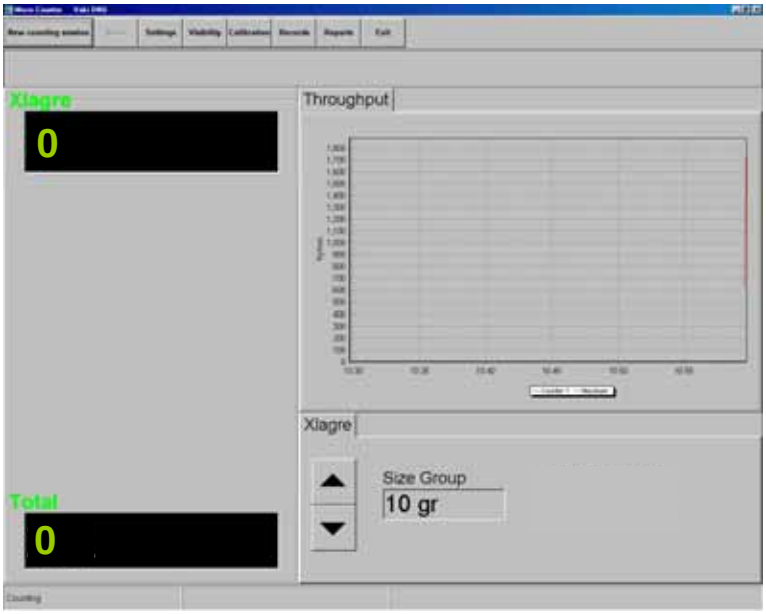
Text such as the site name, tank identification, the population / year class can be entered by pressing the keyboard buttons as indicated. This information will be included in the report. Press "**enter**" on the keyboard after typing. IT IS IMPORTANT THAT ONLY LETTERS AND NUMBERS ARE USED WHEN A NAME IS GIVEN. DO NOT USE SIGNS SUCH AS (/ , . & - OR THE DATA FILE WILL NOT BE SAVED.

The main screen of the program displays two numbers.

Batch count →

The counter should now show 0 in both counting windows. Start pumping or netting the fish into the counter.

Total count →



There are 2 options when you are finished counting a batch of fish.

1. Store current batch and count a new batch to be included in the report for this counting session.
2. Stop counting and end counting session.

7.4 Store and Continue Counting

The batch count can be stored by pressing the "**Store**" button. The batch number will be stored to the report together with the time label. The batch count reset to 0. To continue counting first reset the size range if required, and start pumping or netting the new batch of fish.

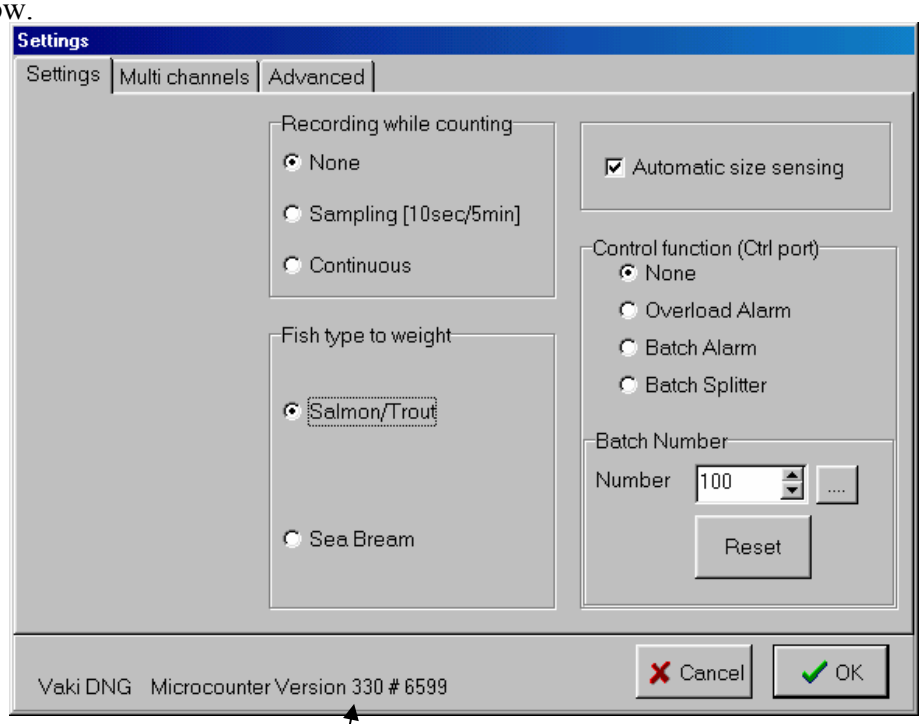
Example: Start new count and count from tank No 1. 10,000 fish. The Batch count will show "10000" and the "Total" window the same "10000". Press "**Store**" and then from tank, No 2 you count 15,000 fish. The batch count now shows "15000" and the "Total Count" window shows "25000" fish.

7.5 End counting session

When counting is finished press **"End counting session**". The numbers and information about the counting session are stored into the counting report. It is now possible to view, print reports and start a new counting session. *Note: if counting batches remember to store the last batch before ending the counting session.*

8 SETTINGS

To access the settings function press **"Settings**" on the main screen. You will then see the screen below.



The program version is shown here

8.1 Recording while counting

The counter can record and store images of the counted fish in the memory of the computer. This function can be used to verify the accuracy of the count.
There are 3 options:

None: No recording
Sampling: 20 second sequence every 5 minutes.
Continuous: Records all images during the counting session.

NB! The image files are big; 20 seconds of images are approx. 2 MB.

8.2 Automatic Size sensing

Enables the counter to calibrate the counting software to the average size of the fish passing through the counter. If this option is not checked the counter will not change the size conditions and will display **Disable** in the ***Estimated size*** window.
It is strongly recommended to keep this option checked.

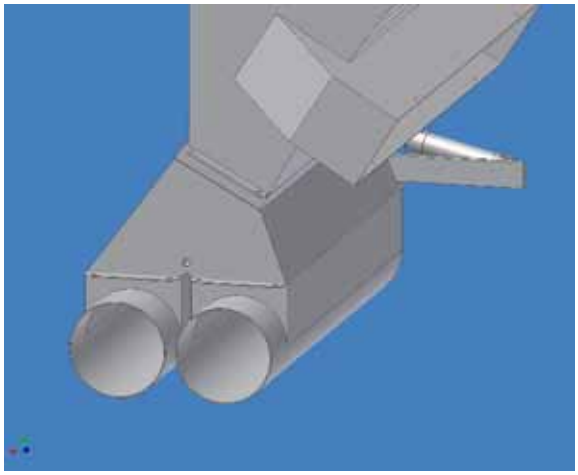
8.3 Fish Type

Selects the species for the biomass function.

8.4 Control function

This function is for devices connected to the "**Ctrl**" connector on the counting head.
There are 4 options:

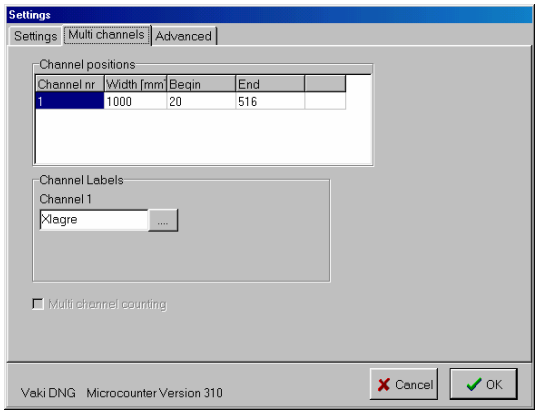
1. **None**: No control function activated
2. **Overload Alarm:** enables an external alarm to sound when the counter is overloaded.
3. **Batch Alarm:** sets the external alarm to signal when the batch number is reached.
4. **Batch Splitter:** this controls a batch splitter with twin outlets. This function counts a pre-selected number of fish through the counter into one outlet, then automatically switches to the other outlet and resets the batch count.

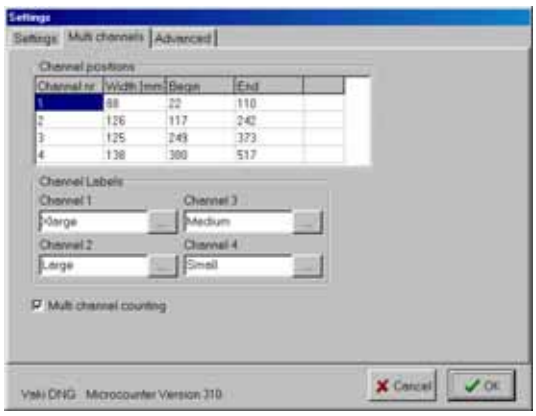


Batch Number: This is used to set the number at which the batch alarm or batch splitter will be activated.
"Reset" this button is used to turn off the external alarm and to switch between outlets on the batch splitter.

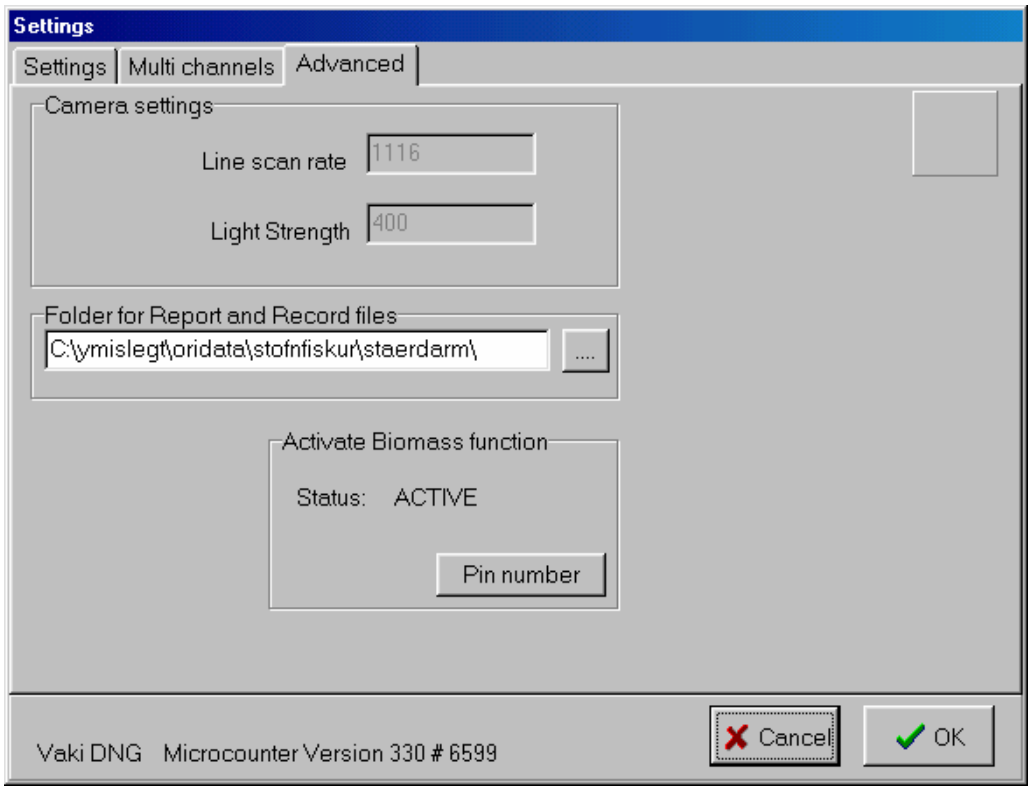
8.5 Multi channels

The **Settings** screen (below left) is displayed for single channel counting; on the right is the multi channel counter. The channel positions indicate the width of each counting channel.
The **Channel Labels box** is used to name the counting channels. To change a multi channel counter to single channel counting remove the tick from the Multi channel counting box.





8.6 Advanced



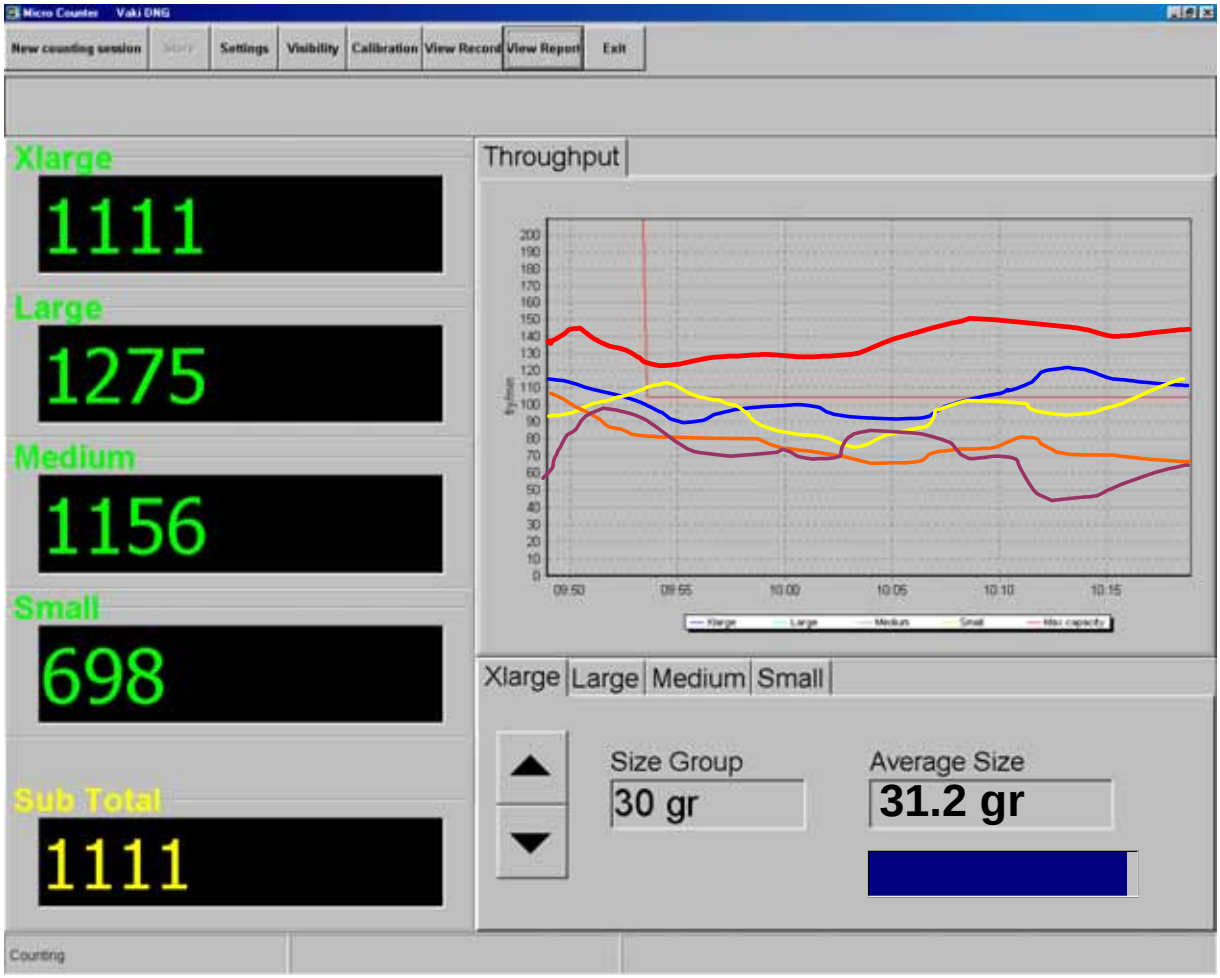
"**Line Scan Rate**" Shows how many lines per second the camera is scanning.

"**Light Strength"** This value indicates the strength of the lamp. Normally this value should be 600 – 900. Should the value drop below 500 this suggests the lamp tube should be replaced.

Folder for Report and Record files: This shows where the folder is located that stores the report and image files created after a counting session. The preset folder is **c:\reports\.**
The file location can be changed by pressing the dotted button to activate the keyboard to type the folder name and location. The user must be sure that this new folder has been created on the computer.

Active Biomass function: Indicates the status of the biomass function.

9 MULTI CHANNEL COUNTING

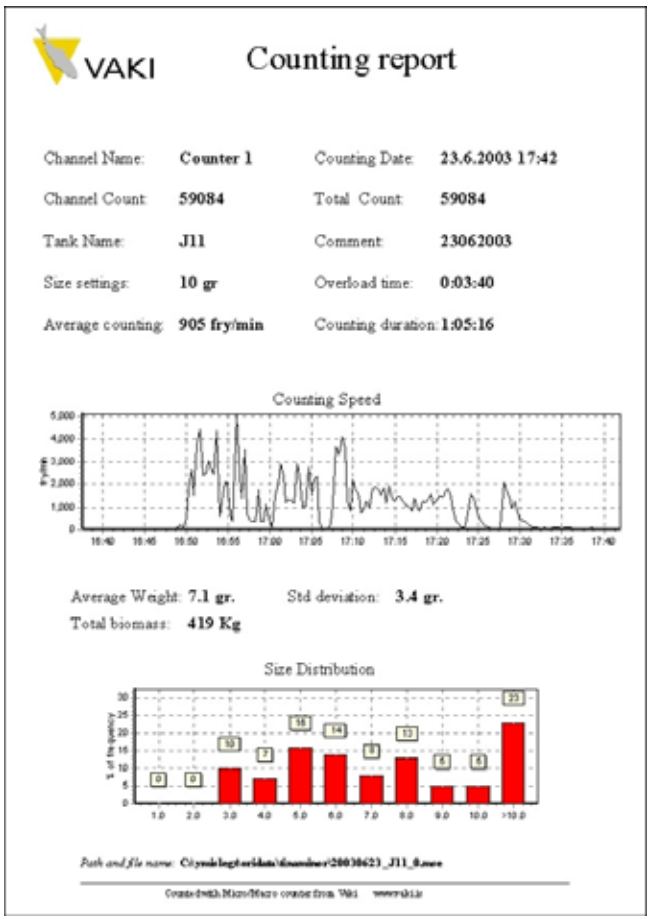


The main screen shows the batch numbers for each counting channel and the total at the bottom.
The names of each counting channel are set up in the settings section. The size groups must be set for each individual counting channel.
Average weight is indicated with the Biomass function activated.
The average weight is not displayed until the required sample is measured.
The moving blue bar is an indication of the sample level, once sample is complete the blue bar disappears and the average weight is displayed.

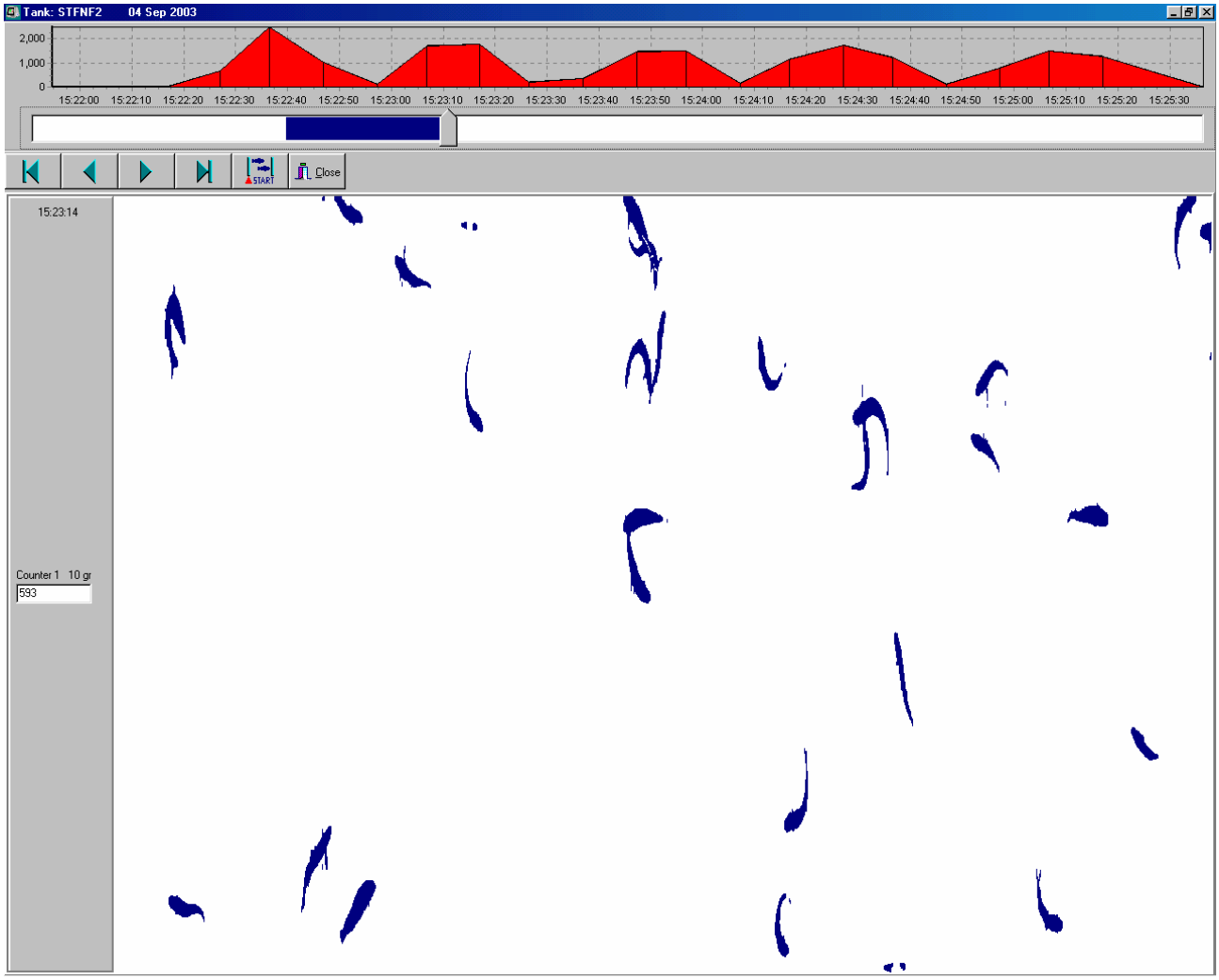
10 VIEW REPORT

After pressing "**End counting session**", the programme automatically creates a report file. To open and view the reports press the "**View Report**" button on main screen. A list of all stored counting reports is displayed. Each report is labelled by date and tank name. The report shows the total number of fish and the number in all batches, the total counting time, average counted fish/min, maximum throughput in fish/min, overloading time, name of the site and number of the tank etc. A graph showing the rate of fish through the counter is included in the report as shown.
With the Biomass function average weight, , total biomass, standard deviation, and size distribution chart is included in the report.

A company logo can be printed on the top left of the report. The logo must be in a Windows Bitmap format and under the filename logo.bmp in the folder **c:\ori**



11 VIEW RECORD



To view the images stored press "**View Record**" on the main screen. The files are labelled by date and tank name, open the file to be viewed from the list. Each screen shows a recording for around one-second interval.
The graph at the top of the screen indicates the rate of fish through the counter over time.

◄, ► buttons are used to move to the next screen
|◄, ►| buttons locate the beginning and end of the recording.
Start/End button, is used to select a part of the recording to be counted.
The pointer indicates the location of the screen currently viewed and can be dragged to quickly locate a position in the recording.
"Close" to exit.

12 CALIBRATION & VISIBILITY

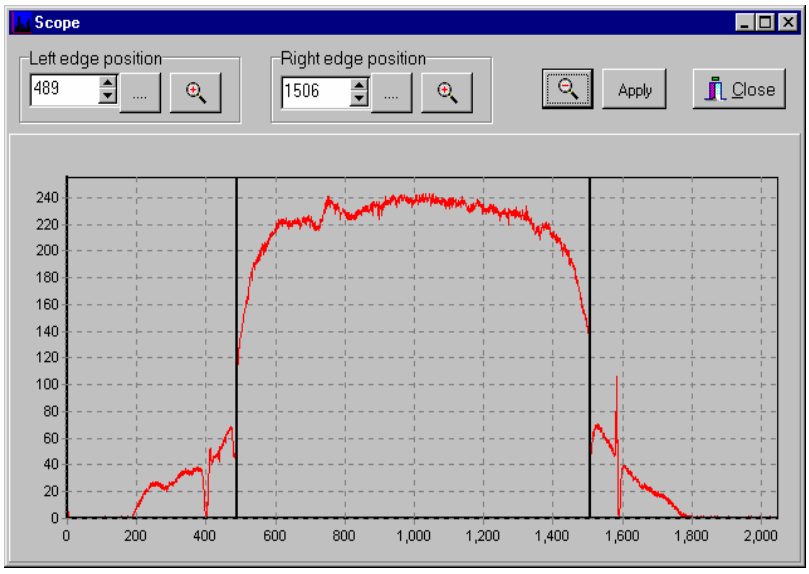
Each time the counter starts it calibrates and checks the visibility of the camera. This includes the following checks:

- The scanning area of the camera.
- The intensity of the light detected by the camera.

If the visibility is not acceptable, the following message will appear "**Insufficient visibility check again?**" To find what is wrong, push the "**Visibility**" button.

12.1 Visibility

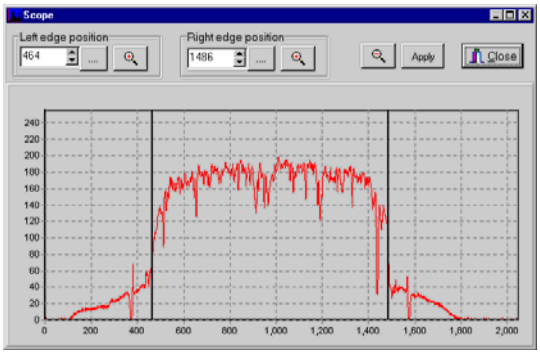
Press **"Visibility"** button to show the visibility graph:
The black vertical lines indicate the edges of the area scanned by the camera, which should correspond to the inside edges of the counting channel.



The "**Visibility"** function is also used to check that the camera is correctly positioned and the amplification of the light is correct. It is also possible to check if dirt or residue blocks or disturbs the sight of the camera.

This diagram on the left shows how the graph should look. It shows the position of the edges of the scanning area with two vertical black lines. It also shows that the light intensity detected by the camera is even. The scanning area on this graph is the distance between 500 and 1500 on the x-axis, and on the y-axis, the strength of the light is approx. 220. The x-axis is the length of the scanning area in pixels (1 pixel = 0.5 mm). The graph for Micro should indicate 1,000 pixels (500mm) and the Macro 2,000 pixels (1,000mm). The y-axis is the strength of the light on scale 0 to 255. The counter ignores the area outside the edges. If the strength is under 180 or over 250, the counter must be re-calibrated. (See section: **12.2 Counter Calibration**)

The diagram on the right shows how the graph can look when something disturbs the light. In this case, the reason may be humidity or dirt on the mirror. This would prevent calibration of the camera. In this case, it is necessary to clean the mirror.

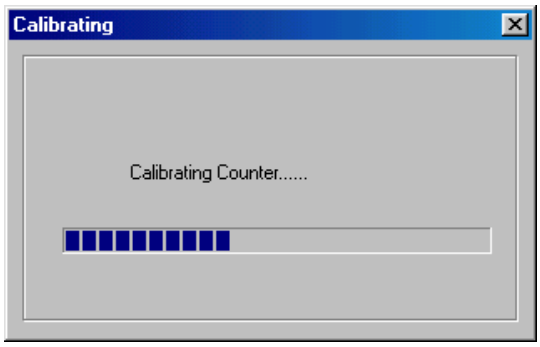


The black vertical lines should be positioned where the light intensity (shown by the red curve) falls steeply. If not it is necessary to re calibrate (**see Counter Calibration**).

If no red curve appears this may be caused by, no light source (lamp) or the counting head is not positioned correctly on the counter body.

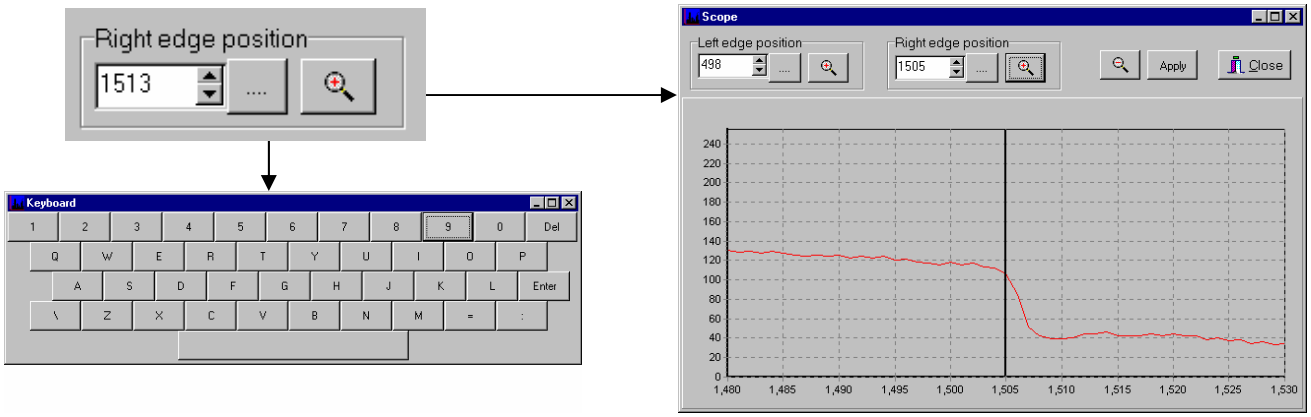
12.2 Counter calibration

The **Calibration** function calculates a new position automatically. Press "**Calibration**" button on main screen with no water running through the counter.
It is also important that the lamp has been on for five minutes or more and the mirror and camera window are clean.
Wait until **counting** message appears on bottom left of screen.
It is good practice to re check the "**Visibility**" graph. If the edges of the scanning area are still not acceptable then it may need to be done manually.



12.3 Setting Edge Position Manually

If, after **Calibration,** the edge positions are still incorrect then it is possible to set positions manually. This is done separately for left and right side by pressing the magnifying glass at each side to zoom in to each edge position. Check the number on the X- axis where the red line drops. This value should be set as the edge position. Press the "Keyboard button" and set the number for the edge position.



13 STORING

When storing the Bioscanner Micro or Macro it is important to bear the following in mind:

- Store the Counting Head in a safe, dry place where temperature fluctuations are not great.
- Clean any salty seawater off the counter with fresh water after use.
- Ensure the counting head is handled with care.

14 TECHNICAL SPECIFICATION

Macro Size:
1.6 x 1.2 x 1.6-2.4 m (L x W x H)

Micro Size:
2.4 x 0.7 x 1.6-2.4 m (L x W x H)

Material: Stainless steel (AISI 316L)

Light source:

Micro Counter	Macro Counter
18W 60cm 18/12-950	36W 120cm 18/12-950

Osram colour ref 950

Power consumption: 110/220 V
UPS requirement: 80-100W

Size of inlet/outlet pipes: 4" or 6"

Size of dewatering pipe: 4" or 6"

Capacity:

Fish size	**Micro Counter**	**Macro Counter**
	Fry/min	
0,5 g	9500	14000
1 g	6500	10200
3 g	4300	7200
10 g	2800	4800
30 g	1600	3080
100g	800	1600
200g	600	1200

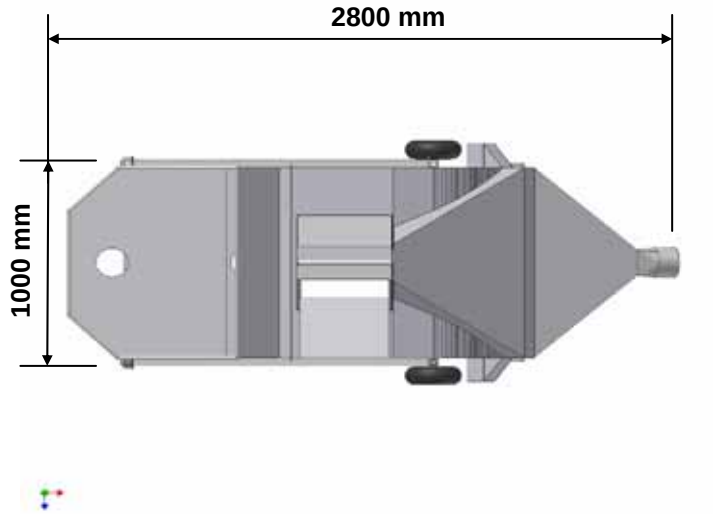
Accuracy: 98% -100%

Fish sizes: Macro 0.2g – 400g
Micro 0.2g – 200g

Fish species: Sea bass, sea bream, salmon, trout, halibut, turbot, tilapia, cod, and ornamentals.

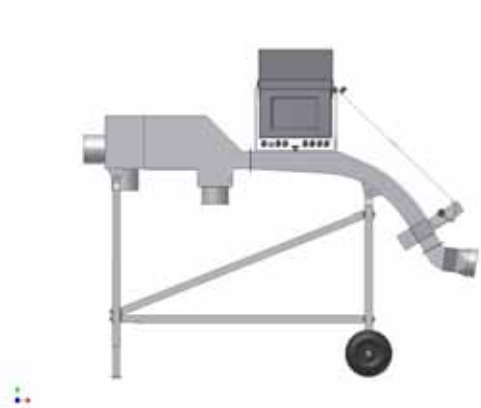
15 STANDARD COUNTERS

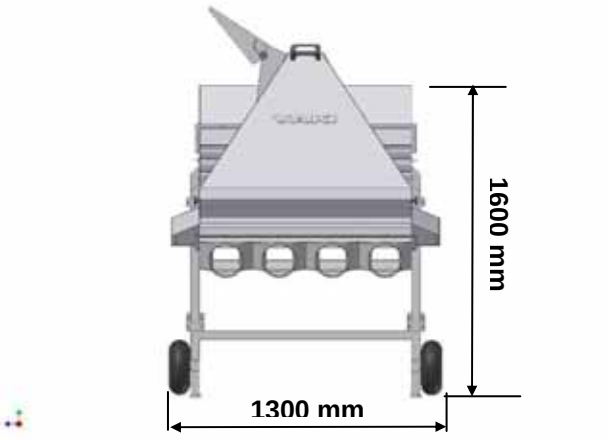
Single Channel Macro



Legs are adjustable for up to 500mm extra height.
Sizes are approx. for a standard counter.

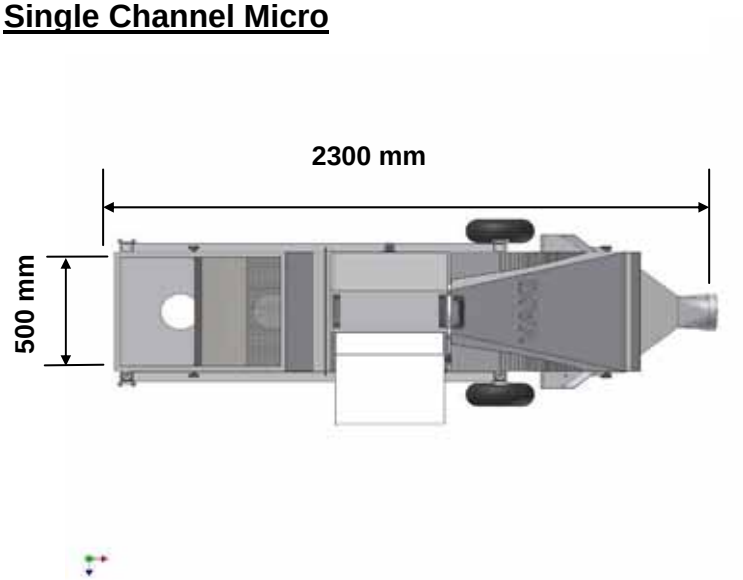
4 Channel Macro Quattro





The Macro counter is split into 4 separate counting channels. The channel dividers in the inlet can be removed and the upwelling inlet used to convert to single channel for fast deliveries.

Single Channel Micro



The counting channel is 500mm wide x 70mm deep. The Micro can also supplied as a 3 channel counter.